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ABILITY GROUPING AND SELF-EFFICACY IN MATHEMATICS

INVESTIGATING ABILITY GROUPING AND SELF-EFFICACY
IN MIDDLE GRADE MATHEMATICS

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science
College of Education
at the University of Kentucky

By

Ashley Gail Hall

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and Dr. Ellen Usher, Associate Professor of Educational Psychology

Lexington, KY

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ABSTRACT OF THESIS

INVESTIGATING ABILITY GROUPING AND SELF-EFFICACY
IN MIDDLE GRADE MATHEMATICS

Ability grouping has been prevalent in American schools for over a century (Burris & Welner, 2005; Museus, Palmer, Davis & Maramba, 2011; Slavin, 1990). Although ability grouping has been studied in terms of student performance, little research has examined the relationship between this practice and student motivation. The purpose of this study was to examine middle school students' ($N = 2,279$) mathematics self-efficacy and its sources in ability grouped mathematics courses in the Southeastern U.S. The study also examined whether students in each ability group were represented proportionately by gender, ethnicity, and SES when compared to the full sample. Students responded to Likert scaled items assessing self-efficacy and its four sources (Bandura, 1997). Tests of mean differences in self-efficacy and its sources revealed that students in above-level courses reported significantly higher levels of self-efficacy than students in on- and below-level courses. Regression analysis revealed that mastery experiences, social persuasions, and negative physiological state predicted self-efficacy for above- and on-level students. Only mastery experiences and vicarious experiences predicted mathematics self-efficacy for below-level students. Results imply that teachers who work with students who are struggling in mathematics may find it beneficial to provide ample opportunity to expose students to models in mathematics.

KEYWORDS: ABILITY GROUPING, MOTIVATION, SELF-EFFICACY, SOURCES OF SELF-EFFICACY

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ABILITY GROUPING AND SELF-EFFICACY IN MATHEMATICS

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ABILITY GROUPING AND SELF-EFFICACY IN MATHEMATICS

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Chapter 1: Introduction

Secondary students across the United States are behind in comparison to their peers across the globe when it comes to mathematics performance. Results from the Program for International Student Assessment (PISA) exam in 2000 and 2009 confirmed the lack of progress among U.S. secondary school students and also indicated that the United States was one of several countries whose secondary student mathematics performance worsened over time (United States Department of Education, 2009). The PISA exam is designed to measure students' level of competency in the mathematics domain and is administered to students at the age of 15. In the U.S., the PISA takes place right after students have exited the middle school environment where mathematics courses are often tracked according to students' ability level (Mantle, 2013).

The United States federal government has established proficiency levels that students are expected to reach over the course of the school year in subjects such as science and mathematics. The National Assessment of Education (NAEP) sets the proficiency standard for schools in the United States (Peterson, Woessmann, Hanushek, & Lastra-Anadon, 2011). Student performance is gauged relative to an established benchmark proficiency score, and students are identified as below-level, on-level, or above-level in comparison with their peers.

Because ability grouping is prominent in middle school classrooms across the United States, it is probable that this practice is not only contributing to the decline in mathematics competency among students, but may also influence the beliefs they hold regarding their capabilities within this domain. Until now, much of the research on

ability grouping has been focused on how this educational practice might affect students' achievement and/or level of competency and academic performance. Fewer studies have examined the relationship between course placement and students' beliefs about their capabilities in mathematics.

Over the past century, the terms ability grouping and tracking have been used to refer to practices that involve grouping students together who are of similar academic abilities (Betts, 2011). Typically, ability grouping begins within the elementary school classroom and consists of splitting students up into smaller groups (i.e., according to their academic performance) within the same classroom. In the middle or high school setting, ability grouping is often referred to as tracking and is often characterized by grouping students of similar academic background together in separate classrooms (or tracks) in subjects such as Science and Mathematics (Mantle, 2013). Because tracking and ability grouping practices are implemented in similar ways within schools (by splitting students up according to their academic abilities), I will continue to use the phrase "ability grouping" to refer to all grouping practices mentioned within this study.

In the United States, ability grouping originated in the early 20th century when a large number of immigrant children enrolled in primary and secondary schools (Hallinan, 2004). To effectively serve the entire population of students, school administrators separated students into different groups based on test results or their past performance in school. Over the next sixty years, most U.S. schools adopted some form of ability grouping as standard practice due to the underlying assumptions that: (a) students learn better around other students who mirror their own academic abilities, (b) students with

academic difficulties develop more positive attitudes when they are not in contact with students who have demonstrated academic strength, (c) track placements are representative of a meritocratic system (e.g., student assignments are “earned” through fair practices), and (d) instruction is simply easier for teachers when students are grouped homogenously by their academic abilities (Oakes, 1985).

By 1990, findings related to ability grouping and its implications for students’ academic and psychological well-being were mixed within the educational research community. Some researchers found that ability grouping practices were only beneficial for high achievers and that these students performed better when enrolled in accelerated classes for the so-called gifted and talented (Kulick, 1991; Reuman, 1989). On the contrary, Slavin’s (1990) comprehensive review of ability grouping practices among secondary students across the United States revealed that ability grouping practices have no effect on academic achievement.

Although ability grouping received much criticism in the 80s and 90s, the practice has experienced resurgence within the last decade due to what some have described as America’s obsession with competition and increasing the academic performance of students at a younger age (Kohn, 2011). This phenomenon, also known as vertical reference, is defined as teaching students skills and concepts at a higher grade level in order to prepare them (in advance) for a future curriculum (Kohn, 2011).

Researchers have examined the potential benefits of learning a higher order curriculum at a younger age by comparing the academic performance of two groups of sixth grade students who qualified for early challenge mathematics coursework (Hemphil

& Hill, 2013). The first group of students qualified for the early challenge work based on their previous academic performance. The second group qualified for the early challenge mathematics coursework based on teacher recommendations because their previous academic performance fell beneath the academic threshold for admission. Results indicated that regardless of previous academic performance, providing an enhanced curriculum (e.g., the early challenge mathematics coursework) to students of all academic levels in sixth grade effectively prepared them for pre-algebra classes the following academic year.

Ability grouping practices may also influence students' motivation. Ability grouped classrooms provide a unique environment where students are grouped with those of similar academic ability. It is an environment that is chosen by school administrators for students. Therefore, ability grouping is likely linked to cognitive antecedents such as self-efficacy because as a student in a homogeneously grouped environment, it may inform how the student thinks about his or her capabilities.

Theoretical Framework

Social cognitive theory posits that human functioning occurs through triadic reciprocal determinism, a continuous interplay between personal factors (i.e., cognitive, biological, affective states), the environment, and behavior (Bandura, 1986). What sets this theory apart from past explanations of human behavior is its emphasis on human agency, or "the power to originate actions for given purposes" (Bandura, 1997, p. 3). Before this theory was developed, human behavior was explained largely by researchers such as Skinner (1971), in terms of responses to the stimuli presented within the

environment instead of resulting from people's choices. In this view, people do not play an active role in their decision-making processes or actions and are simply passive pawns being moved about by events that have occurred around them.

Social cognitive theory recognizes that individuals 1) possess the ability to regulate their own thoughts, beliefs, and motivation, 2) can determine their own behavior, and 3) can also influence and change the environment around them. This theory is the foundation for the present study because it highlights the interconnectedness between ability-grouped classrooms (environment), students' beliefs (personal factors) about their ability to succeed in mathematics, and their performance (behaviors) in the classroom.

Self-efficacy beliefs are the central construct of Bandura's (1986) theory. These beliefs play a crucial role in shaping students' academic performance, are indicative of what students expect to do and/or accomplish, and serve as a source of action. Moreover, what students believe about their own capabilities influences how much effort they will put into their endeavors, how long they will persevere in the face of obstacles or failures, and their resiliency to adverse situations (Bandura, 1997). For example, a below-level student who is optimistic about his capabilities (high self-efficacy) in mathematics (personal factor) will likely keep trying when he does not get the right answer the first time. He will also likely seek help from other peers or his teacher (behaviors). This student's perseverance may lead him to be placed in an "on-level" or "above-level" course.

Because of the bi-directionality of the factors within social cognitive theory, course placement level and self-efficacy beliefs can also influence students' overall

behavior within the classroom. For example, if students begin to internalize their below- or on-level course placement, then they may start to feel discouraged about their ability to succeed in mathematics. In other words, students may feel as if their placement defines them; which limits their potential and future aspirations. Consequently, this could lead to a decline in the number of students who might enroll in higher-level mathematics courses in the future. A student who is accustomed to receiving all A's on his report card and is always in the "top-group" and is placed into an on-level course (environment), may express a defeatist attitude (a personal factor) about his capabilities in mathematics, feeling as if he is not as good at mathematics as he initially thought. As a result, this student could put forth less effort, disengage when confronted with a problem, participate less in class, and/or refrain from enrolling in future mathematics courses. However, other students may respond differently to course placement. Each student's interpretation of his successes and failures in the classroom is unique.

Bandura (1994) hypothesized that people form their efficacy beliefs by interpreting information from four sources: mastery experience, vicarious experience, social persuasions, and their own physiological and affective states. Mastery experience refers to the interpretation of the results of one's performance. Bandura (1994) calls this interpretation an "enactive" experience that can be caused by failure or success. Success within a particular domain or experience makes students feel confident about their abilities. On the other hand, failure typically lowers efficacy beliefs, but it can also serve as a motivator if the individual chooses to interpret the failed experience in an optimistic manner.

Vicarious experience is a second source of self-efficacy and occurs when individuals observe the attainments of others and make judgments about their own capabilities to succeed or fail (Bandura, 1994). For example, students in below-level mathematics courses who are struggling to solve a problem may feel better about their capabilities to solve the problem if they watch their teacher or peers solve the problem first. In addition to this example, a student in a below-level mathematics course who witnesses a peer struggling with a problem who eventually figures out the solution, may feel inspired about her own capabilities to keep trying when grappling with a difficult problem.

Social persuasions, a third source of self-efficacy, refer to evaluations from others within the environment (Bandura, 1994). These evaluations can serve as a positive source of persuasion or a negative source. For example, an on-level student who receives continuous encouragement from her teacher regarding her performance in mathematics might feel inspired to keep working her way up to an above-level course. Oppositely, a student in a below-level class might be left with a feeling of discouragement regarding his capabilities in mathematics after being told by his parents that no one in the family is good at mathematics.

Physiological and affective state is a fourth source of self-efficacy and refers to an individual's inner feelings or emotions that doing something brings about (Bandura, 1994). These inner emotions can be negative such as fear and anxiousness or positive such as excitement and joy. For example, a student who has always performed well in mathematics might feel elated about entering a mathematics classroom. On the contrary,

a student with a history of failure or one who receives negative messages about mathematics may have a feeling of dread when entering a mathematics classroom. These feelings become a sign to the student of what she can or cannot do.

The efficacy-relevant experiences students have in mathematics typically occur in their mathematics classroom. That is, many of the sources of self-efficacy are present during typical classroom operation. Therefore, classroom operation and structure is particularly important because it can expose learners to different sources of self-efficacy. For example, below-level students may need more exposure to models (peers or teacher) to help them feel confident whereas social persuasions could help increase the efficacy beliefs of students at every academic level. This study will explore whether 1) the environment (i.e., a homogeneously grouped classroom) is associated with students' efficacy beliefs in mathematics (personal factors), and 2) whether self-efficacy sources are related to students' performance in mathematics.

Chapter 2: Literature Review

Because ability grouping practices have been widely used within the educational system for over a century, many researchers have investigated how these practices might be linked to students' achievement (Hallinan, 2004). In this section, I will review the various ways in which ability grouping has been linked to students' academic performance, other learning outcomes, and teachers' instructional practices. Next, I will discuss the disproportionality of certain subgroups within ability grouped classrooms. I will then review studies that have examined the relationship between ability grouping and students' self-beliefs (e.g., self-concept, self-esteem, self-efficacy, and the sources of self-efficacy). Finally, I will explain the purpose and significance of the current study which examines the relationship between ability grouping and students' self-efficacy beliefs in middle school mathematics.

Ability Grouping and Learning

Ability grouping practices are not always reflective of students' ability. At the turn of the 21st century, educational psychologists began looking at the myriad of factors that contributed to mathematics achievement and course placement – including students' level of motivation, parental involvement, and the allocation of resources and teachers (Betts & Skolnik, 2000; Dweck, 1986; Useem, 1992). Teachers are not the only adults who play a part in determining a student's course placement level. In fact, Useem (1992) found that highly educated parents were more likely to push for higher track placements for their children compared to other parents.

More recently, Schofield (2010) completed a comprehensive literature review of the methods that other developed nations such as Germany have employed to maintain a school system of homogeneous, ability grouped students. He explored the possibility that the hierarchically tiered educational system or separate schools (based on ability grouping) that are commonly found within European countries are associated with a larger achievement gap for secondary students.

Results revealed that having high-ability classmates was associated with increased achievement. Moreover, ability grouping with curriculum differentiation or separated schools increased the achievement gap among students favoring those students in higher-level classes and advanced-level schools. A stronger link was also found between students' social backgrounds and their achievement in school systems with more curriculum differentiation and earlier placement in comparison to the link between students' social background and schools without curriculum differentiation. In other words, this study showcased how social backgrounds (personal factors) can play a role in course placement, which in turn can influence students' academic achievement (behavior). The study also brought attention to the potential relationship between ability grouping practices and the achievement gap among students (Schofield, 2010).

Other studies have compared homogeneously grouped classrooms (every student at the same ability level) with heterogeneously grouped classrooms (each student is of a different ability level) in an effort to determine which environment is most conducive to learning for all students. For example, Venkatakrishnana and William (2003) conducted a longitudinal study in Greater London with a cohort of students ages 14-16 who were

tracked into two ability based groups: the fast-track and the mixed-track. The fast-track was made up of students in the top 25-30% of the class and the mixed-track was made up of the remaining 70-75% of students.

Results suggested that fast-track students were not significantly advantaged by their placement. Students in the mixed-ability group, on the other hand, displayed a statistically significant amount of progress over the course of the academic year in comparison to their prior attainment. Moreover, placement in the mixed-ability group gave lower attaining students an advantage toward successful performance in the classroom.

German educational psychologists Hanushek and Ludger (2005) wrote an international comprehensive review of grouping differences by comparing the academic outcomes between primary and secondary schools across tracked and non-tracked systems. Six international student assessments provided eight pairs of achievement data for contrasts between groups. They contended that early tracking increased educational inequality among students performance on reading and mathematics achievement tests. Students who were grouped by ability at an earlier age had lower achievement scores in comparison to those students who were grouped at a later age.

Hoffer (1992) analyzed the effects of ability grouping on the cognitive achievement of middle school students in mathematics and science who attended either grouped schools or non-grouped schools. Gains from ability grouping were negligible, even controlling for differences in social background and initial levels of achievement. Moreover, academic achievement results revealed that placing students in high achieving

groups generally had a positive but weak effect on their academic performance. Low group placement, on the other hand, had a strong, negative effect on students' academic performance.

Cheung and Rudowicz (2003) collected achievement data and teacher reports for 2,720 junior high students who were placed into mixed and homogeneous ability grouped classrooms in Hong Kong to examine students' studying behaviors. The sample included 12 low-ability schools, 5 medium-ability schools, and 6 high-ability schools. Results indicated that students' self-esteem was negatively affected by ability grouping practices. In addition to this finding, researchers also determined there were no detrimental side effects to studying habits as a result of students being placed into ability grouped classrooms. Also, students who were placed into more homogeneously grouped classrooms had significantly higher academic achievement and self-esteem than their counterparts who were placed into mixed ability grouped classrooms. It bears noting that these students were grouped by school and not by classroom within a single school, which may have reduced the negative stigma associated with being in a lower ability group.

Carbonaro (2005) examined the links among students' effort, tracking, and academic achievement and concluded that students in higher tracks put forth a substantial amount of effort compared to students in lower tracks. This conclusion was largely determined by accounting for students' previous efforts, which aided them in getting into the higher track classes. However, the effect that students' effort had upon their learning was roughly the same, regardless of course placement level.

Ability Grouping and Instructional Practices

Ability grouping can also play an influential role in a teacher's choice of instructional methods within the classroom. For instance, Goodlad (1984) found that in U.S. schools, more effective teaching practices were being used in upper tracks than in the lower tracks. Teachers in the upper tracks used more clarity, organization, and enthusiasm, and placed greater emphasis on higher level cognitive processes such as drawing inferences, synthesizing, and making judgments. Additionally, Ascher (1992) found that students in higher academic tracks often received enriched and challenging lessons/tasks, and students in lower tracks were completing tasks that involved rote learning and memorization.

Weis, Parsley, Banilower, and Heck (2003) suggested that regardless of the goals members of the educational community have set forth to ensure learning for *all* students, learners who struggle in mathematics or who have special education placements have less access to rigorous mathematics instruction. Teachers can inadvertently or intentionally influence the efficacy beliefs of their children by controlling the level of engagement with students (Pajares & Urdan, 2006). For example, a teacher who is sensitive to the academic needs of a student who is struggling in mathematics may ask a number of conceptual questions in order to determine what the student does or does not know. Placing the student in a situation where she must explain the concepts and reasoning related to the solution, builds that student's sense of efficacy to solve the problem independently.

Disproportionality of Certain Subgroups in Ability Grouped Classrooms

Even though ability grouping is still used in schools today, many potential risks and hurdles have been associated with the practice over the past few decades. One of these hurdles is the disproportionate representation of certain subgroups of students in lower level ability groups (Burris & Welner, 2005; Hoffer, 1992; Museus, Palmer, Davis & Maramba, 2011; U.S. Dept. of Education, 1995).

There is little evidence of disproportionate numbers regarding ability grouping practices and gender. However, Pinker (2009) contended that gender may differently influence the ambition and future success of girls and boys. For example, the National Assessment of Educational Progress (NAEP), given to students in fourth and eighth grades in the U.S., revealed that girls who are enrolled in advanced-level classes in elementary and middle school are more likely to enroll in advanced-level courses in high school and are also more likely to have a plan for obtaining a secondary education when compared to their boy counterparts (Pinker, 2009). Azar (2010) found that the recent shift in numbers between sexes in mathematics is due largely to the increased number of girls who are enrolling in higher level mathematics courses. The present study will examine the proportion of boys and girls within each course placement level then compare it to the number of boys and girls within the full sample.

Because ability grouping has been linked to discriminatory practices, many studies within the last decade have also examined the equal representation of racial minorities in below-, on-, and above-level courses (Burris & Welner, 2005; Futrell & Gomez, 2008; Museus, Palmer, Davis & Maramba, 2011). These studies concluded that

racial minority students tend to make up the majority of the population in below- and on-level courses in comparison to other racial groups. This study will also examine the proportion of racial minority students in each course placement level and compare it to the proportion of racial minority students in the full sample.

Oakes (1992) suggested that tracking exacerbated differences in learning and achievement among students and could be linked to social class and race. Moreover, Oakes posited that these learning differences were a contributing factor to the gaps in achievement found between disadvantaged and affluent students. Many psychologists have labeled ability grouping as problematic because it often relegates racial minorities and students of lower socioeconomic status to on-level and below-level classes (Braddock, 1990; Braddock & Dawkins, 1993; Oakes, 1992).

More recently, Boaler (2006), conducted a study in the United Kingdom that uncovered unfair grouping practices related to socioeconomic status. Children within this study were being placed in ability grouped classrooms based upon their social class standing; with pupils from middle-class backgrounds more likely to be assigned to higher level courses, irrespective of their prior attainment. The present study will examine students' socioeconomic status in conjunction with their course placement level to determine if there is a disproportionate amount of students from lower-income backgrounds in the below- and on-level courses.

Ability Grouping and Students' Beliefs

Many psychologists have contended that relegating students to certain tracks based on their abilities within a particular domain can affect students' beliefs about what

they can do and their sense of motivation (Boyer, 1983; Kerble, 1988). Kerble (1988) randomly assigned a group of sixth and seventh grade students to a low or high track at the beginning of the school year. Results showed that students' perceptions of themselves and others were affected by the ability group to which they were assigned. Moreover, Kerble contended that a student's self-image relates to his or her learning potential; the stronger the self-image, the greater the learning potential. Therefore, because students' self-images were influenced by their course placement, it is likely that their efficacy beliefs and motivation were also influenced by ability grouping practices.

In an attempt to highlight how ability grouping can influence students' future aspirations in mathematics, Wang and Goldschmidt (2003) applied a hierarchical linear growth model to address the potential inequity of course taking patterns for middle school students. After following the students from eighth grade to eleventh grade, researchers concluded that even when prior achievement was controlled, ability grouping plays a prominent role in identifying differences among students. Students in higher level courses in middle school also chose higher level courses when they got to high school. The number of students in on- and below- level courses in middle school who chose higher level classes in high school was much smaller. This finding draws attention to how course placement can impact students' aspirations and enrollment in future mathematics courses during their high school years.

Ability Grouping and Student Self-Concept

Being placed into an ability grouped mathematics classroom might influence the way students feel about themselves and their judgments regarding their capabilities

within this domain. The long-term outcomes of schooling depend on student self-perception, both as a learner and as a person (Slaughter-Defoe, 1995). Baumeister (1999) defined *self-concept* as people's beliefs about themselves that stem from their own attributes and who and what the self actually is.

Some evidence has shown that students' academic self-concept suffers when they are homogeneously grouped by ability and placed in highly competitive classrooms, even when these students are academically talented (Marsh & Hau, 2003; Marsh, Trautwein, Ludtke, & Koller, 2008). For example, placing students into advanced-level mathematics courses may cause their self-concept to suffer. This is because in advanced-level courses *every* student performs at an advanced level—a classroom full of “big fish” in a little pond. As a result, these students might judge their own sense of worth relative to other students in the classroom. This social comparison can serve as a basis for forming one's own academic self-concept and is known as the Big-Fish-Little-Pond effect (BFLPE) (Marsh, 1984). This effect has been investigated most often at the school rather than at the classroom level, however. Other researchers have reported that students who were placed in higher track courses had significantly higher self-concept in mathematics and school in general (Chiu et al., 2008). Moreover, ability grouping did not affect students' self-esteem, or the extent to which the individuals accepted, approved of, and valued themselves (Macleod, 2008).

Researchers in Belgium recently conducted a study on ability grouping and students' self-esteem (Van Houtte, Demanet, & Stevens, 2012). Like other European school systems, Belgium has completely separate high schools for students of varying

ability levels. This study focused specifically on whether students' feelings of worth were affected differently by processes of within-school tracking (e.g., academic schools) compared to processes of between-school tracking (e.g., vocational schools). Multi-level analyses revealed that students in tracked schools had higher self-esteem than vocational students in separate schools. Moreover, students' reports of self-esteem displayed a wider range of responses in schools that tracked within as opposed to separate, categorical schools for specific academic tracks.

Chmielewski, Dumon, and Trautwein (2013) examined the ways in which between-school ability grouping (which the author refers to as streaming), within-school streaming, and course-by-course streaming can shape students' mathematics self-concept. They concluded that in course-by-course streamed schools (i.e., ability-grouped classrooms within one school) high track students had higher mathematics self-concept than low track students. However, for students in separate ability grouped schools and those students in mixed ability classrooms, high track students had lower self-concepts and low track students had higher self-concepts.

This finding is important because it suggests that low track students feel better about themselves when they are in mixed ability classrooms. Regardless of the way ability grouping is implemented, separating students undeniably affects the way they feel about themselves. In turn, this may also affect how students judge their capability to succeed in the classroom. The present study will examine how course placement level may be related to students' judgments about themselves and their efficacy beliefs in mathematics.

Ability Grouping and Self-Efficacy

If students' motivation contributes to their achievement and course placement, then I postulate that the students' self-efficacy or competence beliefs will vary depending on which course they are placed in (i.e., below-on, or above-level). The aim of this study is to examine the self-efficacy beliefs of middle school students who have been placed into different courses based on their ability level in mathematics. Few studies have investigated the relationship between ability grouping practices and students' *self-efficacy*, or beliefs in their capabilities to perform given tasks (Bandura, 1997). Students who have been labeled as below-level in mathematics by some experience in school, by teachers, or by other peers might report different experiences related to their perceived capabilities than those who have been labeled "talented" or "advanced" in mathematics.

Several motivation theorists have argued that students' perceived competence is a valuable part of their consequential academic achievement (Bandura, 1986; Eccles & Wigfield, 2002). What students believe about their capabilities within a subject will partly determine their performance and achievement within that particular domain (Carrol, 2009; Klassen & Usher, 2010; Lent, Lopez, Brown, & Gore, 1996).

Students' sense of efficacy is important because it not only affects achievement in the classroom but also aspirations (Carrol, 2009). Several researchers have found differences among students regarding levels of academic self-efficacy and exposure to efficacy-building sources. However, these studies were conducted in other academic domains besides mathematics. For example, Usher and Pajares (2006) study examined the influence of Bandura's (1997) hypothesized sources on the academic and self-

regulatory efficacy beliefs of ($N = 263$) students within the subject of reading. They also explored whether these sources differed as a function of gender, reading ability, and race/ethnicity. Results revealed that all four sources of self-efficacy (i.e., mastery experience, vicarious experience, social persuasions, and physiological state) predicted academic and self-regulatory behavior for students in the full sample. The strongest predictor of academic and self-regulatory behavior for all students was mastery experience.

Usher and Pajares (2006) reported that the relationship between the sources and self-efficacy differed by student gender and ability level. For instance, mastery experience did not predict the self-efficacy of students in below-level courses. Below-level readers also reported fewer mastery experiences and social persuasions, a higher level of physiological arousal, and lower academic self-efficacy than above-level readers. Due to the small sample size of below-level students in the study, however, the authors cautioned that results should be considered preliminary. The present study will make comparisons regarding the efficacy beliefs of students in below-, on-, and above-level courses in another domain: mathematics.

Few studies have examined how the educational practice of ability grouping may influence students' self-efficacy judgments within the domain of mathematics, one of the most ability-segregated disciplines in American schools. This thesis will take a closer look at how course placement level (i.e., below-, on-, and above-level) affects the self-efficacy judgments of middle school students. Moreover, the study will also investigate

which self-efficacy sources students in each course placement level rely on when forming their efficacy beliefs.

Purpose and Significance of the Study

The purpose of this thesis research is to examine mathematics self-efficacy and its sources among middle school students in below-, on-, and above-level mathematics courses. The study also seeks to determine whether students in each ability group are represented proportionately by gender, ethnicity, and SES when compared to the full sample. First, I will examine whether students are proportionately dispersed in terms of gender, race, and socioeconomic status among the ability based groups in comparison to the full sample of students. Next, I will compare the mathematics self-efficacy levels of students in below-, on-, or above-level mathematics courses. I will also seek to determine whether students in each ability group report similar levels of exposure to the four sources of self-efficacy (Bandura, 1994). Finally, I will investigate the relationship between the four sources of self-efficacy and students' general self-efficacy and skills self-efficacy in mathematics for students placed in below-, on-, and above-level mathematics courses.

Research Questions

Four primary research questions will guide the study:

- (a) What is the distribution of students in each ability level for the full sample and for each sub-group (i.e., gender, race, and SES)?
- (b) Do students in each ability group differ in their reported levels of mathematics self-efficacy?

- (c) Do students in each ability group differ in their reported efficacy-relevant experiences (e.g., mastery experience, vicarious experience, social persuasion, and physiological state)?
- (d) What is the relationship between the four sources of self-efficacy and ratings of general mathematics self-efficacy and skills self-efficacy for students who are placed in below-, on-, and above-level mathematics?

Chapter 3: Method

Participants

Participants were ($N = 2,279$) students in Grades 6-8 who attended four middle schools in one school district in the Southeastern U.S. during the 2011-2012 academic year (49% female, 51% male; 53% White, 31% African American, 9% Hispanic, 4% Other, 3% Asian; 53% qualify for free or reduced-price lunch). Students who did not complete all self-efficacy measures or for whom we had incomplete demographic information for were deleted listwise and excluded from analysis resulting in sample size of ($N = 1,880$). Students were determined to be below-level ($n = 311$), on-level ($n = 1,367$), or above-level ($n = 601$) in mathematics according to course placement guidelines defined by school administrators (see Table 1).

Table 1

Ability Grouping Information by Student Grade Level and Course Name

Grade	Below-Level (<i>n</i> = 311)	On-Level (<i>n</i> = 1,367)	Above-Level (<i>n</i> = 601)
6		Mathematics 6	Pre-Algebra
7	Mathematics 7	Pre-Algebra	Algebra I
8	Mathematics 8 Pre-Algebra	Algebra I	Advanced Geometry

Note. School administrators stated that there were no below-level mathematics courses for sixth grade students

Procedure

Data collection took place during the second year of a longitudinal study designed to examine student motivation over time. Data were collected by researchers in the P20 Motivation and Learning Lab. This project was proposed and approved by IRB in the fall of 2010. In the fall 2011, students were given a paper survey that included measures of general mathematics self-efficacy, mathematics skills self-efficacy, and sources of self-efficacy. In the spring of 2012, students were given an online survey to complete that included measures of general mathematics self-efficacy and mathematics skills self-efficacy.

Data Sources

I examined the following demographic variables: gender, race, and socioeconomic status (SES). All demographic information was obtained from school records. Socioeconomic status was determined by a student's eligibility for free/reduced-price lunch. Students who paid full price for lunch were coded as 0, and students who received free or who paid a reduced-price for lunch were coded as 1. The primary categorical variable used in this study is course placement. Table 1 explains how course placement was determined for each grade. A variety of criteria was used to determine course placement level in middle school mathematics including but not limited to: teacher recommendations, high scores on previous achievement tests, and parental influence.

I measured six continuous variables: general self-efficacy in mathematics (7 items; e.g., "In general, how confident are you in your abilities in mathematics?"), mathematics skills self-efficacy (27 items; e.g., "How confident are you that you can

successfully solve mathematics problems involving word problems?”), and the four sources of self-efficacy in mathematics: mastery experience, vicarious experience, social persuasion, and physiological state (25 items; e.g., “People have told me that I’m good at learning mathematics”). Students were asked to rate their level of confidence regarding each statement on a scale of 1 to 6; 1 representing the lowest amount of confidence and 6 representing the highest amount of confidence. Both self-efficacy scales were created in accordance with Bandura’s (2006) guidelines. The Sources of Mathematics Self-Efficacy Scale was created by Usher and Pajares (2009). A complete list of self-report measures can be found in the appendix.

Cronbach’s alpha is the most common measure of internal consistency. The value of Cronbach’s alpha is always between 0 and 1; the closer the number is to 1, the higher the reliability of the scale. This measure is commonly used for Likert-scale questions in a survey/questionnaire that form a scale, because it allows one to determine if the scale being used is reliable (Tavakol & Dennick, 2011). Cronbach’s alpha level for general self-efficacy was .934 and the alpha level for skills self-efficacy was .961. Cronbach’s alpha levels for the sources of self efficacy were as follows: .862 for mastery experience, .752 for vicarious experience, .872 for social persuasions, and .868 for physiological state.

Analyses

Means, standard deviations, and correlations were calculated for all variables. To determine whether each ability group was composed of similar proportions of students by gender, race, and SES in comparison to the full sample, I calculated how many students

were in each sub-group and divided that number by the total number of students within each course placement level. For example, the total proportion of girls in each ability group was calculated by dividing the number of girls in each course level by the total number of students in each ability group. This number was then compared to the proportion of girls in each ability level in the full sample (i.e., the number of girls in each course level/number of students in the full sample).

To answer the second research question in the study, I conducted a one-way analysis of variance (ANOVA) to examine mean differences in reported levels of self-efficacy among students in different course placement levels. Self-efficacy scores used in this analysis were from the Spring 2012 survey. For the one-way ANOVA, effect size (ES) was calculated as eta squared and is equal to the sum of squares between divided by the sum of squares total. Values of .01, .06, and .14 represent small, medium and large effects (Sprinthall, 2006).

Next, I conducted a multivariate analysis of variance (MANOVA) and four subsequent univariate ANOVAs to test for mean differences in the four reported sources of self-efficacy among participants in each ability group. Sources of self-efficacy scores used in this analysis were from the Fall 2011 survey.

To address my final research question, I conducted six different linear regressions—one for each ability group—in which each measure of self-efficacy (i.e., general mathematics self-efficacy and mathematics skills self-efficacy) was regressed on the four sources of self-efficacy. Self-efficacy scores used in this analysis were from the Fall 2011 and Spring 2012 time surveys.

Chapter 4: Results

Representation of Students in Ability Groups

The first research question examined whether each ability group was composed of similar proportions of students by gender, race, and SES in comparison to the full sample. I first calculated the percentage of students in each subgroup (i.e., gender, race, SES) within each course placement level and then compared these numbers to the representation of each of the subgroups within the full sample. Table 2 presents the percentages of each subgroup for the full sample and by ability group.

In terms of gender, the full sample was nearly even with 51% boys and 49% girls. Boys and girls were evenly distributed in the below-level courses. However, there were a higher number of boys in on-level courses and a higher number of girls in above-level courses. Within the full sample, there were some notable findings regarding course placement and racial background. For example, White students made up 53% of the full sample, but only 39% of the below-level courses and more than half of the on-level and above-level courses with 55% and 57% respectively. African American students on the other hand, who only comprised 31% of the total sample, took up nearly 46% of seats in below-level courses and accounted for 31% of the sample in on-level courses and 24% of the sample in above-level courses. It is also worth noting that Asian students comprised 3% of the sample population and were only enrolled in on-level and above-level courses with 2% and 5% respectively.

Students who paid full price for lunch made up 47% of the total sample and accounted for 37% of the population in below-level courses, 43% of the population in on-

level courses, and 59% of the population in above-level courses. Students of lower socioeconomic status (e.g., those students who received free and reduced-price lunch) accounted for a larger portion of the total sample, 53% and comprised the majority in below-level courses with a total of 62%. Moreover, these students accounted for 56% of the population in on-level courses, and only 40% of the population in above-level courses. For a complete report of findings regarding gender, race, and SES (see Table 2).

Table 2

Distribution of Students in Various Ability Tracks by Gender, Ethnicity, and SES

	Full Sample (<i>N</i> = 2,279)	Below-Level (<i>n</i> = 311)	On-Level (<i>n</i> = 1,367)	Above-Level (<i>n</i> = 601)
		(<i>n</i> = 311) 13.6%	(<i>n</i> = 1,367) 60.0%	(<i>n</i> = 601) 26.4%
<u>Gender</u>				
Boys	(<i>n</i> = 1,152) 50.5%	(<i>n</i> = 154) 49.5%	(<i>n</i> = 712) 52.1%	(<i>n</i> = 286) 47.6%
Girls	(<i>n</i> = 1,127) 49.5%	(<i>n</i> = 157) 50.5%	(<i>n</i> = 655) 47.9%	(<i>n</i> = 315) 52.4%
<u>Ethnicity</u>				
White	(<i>n</i> = 1,214) 53.3%	(<i>n</i> = 120) 38.6%	(<i>n</i> = 751) 54.9%	(<i>n</i> = 342) 56.9%
African American	(<i>n</i> = 707) 31.0%	(<i>n</i> = 142) 45.7%	(<i>n</i> = 421) 30.8%	(<i>n</i> = 142) 23.6%
Hispanic	(<i>n</i> = 204) 9.0%	(<i>n</i> = 31) 10.0%	(<i>n</i> = 117) 8.6%	(<i>n</i> = 56) 9.3%
Other	(<i>n</i> = 92) 4.0%	(<i>n</i> = 14) 4.5%	(<i>n</i> = 46) 3.4%	(<i>n</i> = 32) 5.3%
Asian	(<i>n</i> = 61) 2.7%	(<i>n</i> = 3) .1%	(<i>n</i> = 29) 2.1%	(<i>n</i> = 29) 4.8%
<u>SES</u>				
Full-Price Lunch	(<i>n</i> = 1,056) 46.7%	(<i>n</i> = 114) 36.7%	(<i>n</i> = 586) 42.9%	(<i>n</i> = 356) 59.2%
Free and Reduced-Price Lunch	(<i>n</i> = 1,205) 53.3%	(<i>n</i> = 192) 61.7%	(<i>n</i> = 770) 56.3%	(<i>n</i> = 240) 39.9%

Mean Differences

A one-way analysis of variance was conducted to examine whether students in each ability group reported different self-efficacy levels (see Table 3). Levene's test for equality of variances indicated that homogeneity was not tenable (Sprinthall, 2006). Therefore, Dunnett's T3 statistic was used to examine the post hoc differences in self-efficacy. There was a statistically significant difference in general mathematics self-efficacy between students in below-level courses and above-level courses. There was also a statistically significant difference in general mathematics self-efficacy for students in on-level and above-level courses. Results revealed a statistically significant difference in skills self-efficacy among students in all ability level courses (i.e. between students in below-level, and on-level courses, between students in on-level and above-level courses, and between students in below-level and on-level courses).

Table 3

Mean Differences in General Mathematics Self-Efficacy and Skills Self-Efficacy

					Below- Level (<i>n</i> = 311)	On- Level (<i>n</i> = 1,367)	Above- Level (<i>n</i> = 601)
	<i>df</i>	<i>F</i>	<i>p</i>	η^2	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
General Self-Efficacy	2, 2057	8.52	<.001**	.008	4.56_a (1.09)	4.70_b (1.09)	4.87_c (0.97)
Skills Self-Efficacy	2,2056	28.91	<.001**	.027	4.91_a (0.94)	5.06_b (0.84)	5.32_c (0.66)

Note. Group means for a dependent variable (row) that are bold and followed by different letters are statistically different $p < .001^{**}$. Students were asked to rate their level of confidence regarding each statement on a scale of 1 to 6; 1 representing the lowest

amount of confidence and 6 representing the highest amount of confidence

I next examined mean differences in the sources of self-efficacy as a function of ability group (see Table 4). Results indicated that there was a statistically significant difference in the sources of self-efficacy based on students' course placement level, $F(8, 4188) = 7.69, p < .001$; Wilk's $\lambda = .971$, partial $\eta^2 = .014$. Levene's test for equality of variances indicated that homogeneity was not tenable for mastery experience (Sprinthal, 2006). Therefore, Dunnett's T3 statistic was used to examine the post hoc differences for this source of self-efficacy. The LSD statistic was used to examine the post hoc differences in vicarious experiences and social persuasions. Above-level students reported higher levels of mastery experience, vicarious experience, and social persuasion as efficacy-building sources in comparison to their on- and below-level counterparts.

There was a statistically significant difference in mastery experience as a source of self-efficacy between students in below-level courses and above-level courses. There was also a statistically significant difference in vicarious experiences among on- and above-level students. A statistically significant difference was found between below-level and above-level students reporting social persuasions as an efficacy building source. There was also a statistically significant difference between students in on-level courses and above-level courses regarding social persuasions and self-efficacy ratings. Students in below-, on-, and above-level courses did not differ in their reported physiological arousal.

Mean Differences in Sources of Self-Efficacy

Note. Group means for a dependent variable (row) that are in bold and followed by different letters are statistically different. $p < .05$ * $p < .001$ **. Students were asked to rate their level of confidence regarding each statement on a scale of 1 to 6; 1 representing the lowest amount of confidence and 6 representing the highest amount of confidence

Note. Group means for a dependent variable (row) that are in bold and followed by different letters are statistically different. $p < .05$ * $p < .001$ **. Students were asked to rate their level of confidence regarding each statement on a scale of 1 to 6; 1 representing the lowest amount of confidence and 6 representing the highest amount of confidence

Relationships Among Variables

The coefficient of correlation provides a quantitative measure of the strength of the linear relationship between two variables. The value of the correlation coefficient of two variables is always between -1 and +1; the closer that the correlation is to 1 or -1, the stronger or weaker the relationship between the two variables (Mendenhall & Sincich, 2011). Correlation results revealed that boys reported significantly higher general self-efficacy in mathematics, more mastery experiences, and lower physiological arousal than girls. Students who qualified for reduced-price lunch reported significantly lower general self-efficacy in mathematics, less mastery experiences and fewer social persuasions. Results also indicated that all four sources of self-efficacy were significantly related to self-efficacy and in the expected direction (i.e., all correlations were positive with the exception of physiological state). Table 5 shows the correlations among the study variables.

Table 5

Correlations, Means, and Standard Deviations for Variables in the Study

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7
1. Gender	0.51	0.50							
2. SES	0.55	0.50	.03						
3. Mathematics General Self-Efficacy	4.73	1.06	.11**	-.10**					
4. Mathematics Skills Self-Efficacy	5.11	0.82	.04	-.14**	.69**				
5. Mastery Experience	4.30	1.16	.04*	-.11**	.62**	.47**			
6. Vicarious Experience	3.94	0.97	.03	-.03	.43**	.36**	.54**		
7. Social Persuasion	3.93	1.28	.02	-.08**	.55**	.43**	.74**	.61**	
8. Physiological State	2.58	1.25	-.10**	.03	-.48**	-.37**	-.65**	-.38**	-.49**

Note. $p < .001$ ** $p < .05$ * Gender was coded as 0-girls and 1-boys. SES was coded as 0-full pay lunch 1- free/reduced-price lunch

Regression Results

Multiple regression analysis was used to examine the relationship between the four sources of self-efficacy and ratings of general mathematics self-efficacy and skills self-efficacy for students placed in below-, on-, and above-level mathematics courses. Results revealed that the sources of self-efficacy predicted students' ratings of general self-efficacy and skills self-efficacy in mathematics. The results of the regression for general self-efficacy in mathematics indicated that the sources of self-efficacy predicted 41.4% of the variance $F(4, 1876) = 331.50, p < .001, R^2 = .414$ for students in the full sample. Within the model predicting general mathematics self-efficacy, the following sources were significant for students in on- and above-level mathematics courses: mastery experience, social persuasions, and physiological state (see Table 6). However, for students in below-level courses, only mastery experience and vicarious experience predicted general mathematics self-efficacy.

The results of the regression predicting skills self-efficacy in mathematics indicated that the sources of self-efficacy predicted 25.0% of the variance $F(4, 1875) = 156.01, p < .001, R^2 = .250$ for the full sample. Again, only mastery experience and vicarious experience predicted mathematics skills self-efficacy for students in below-level courses. For on-level students, all four sources of self-efficacy predicted mathematics skills self-efficacy. Mastery experience, vicarious experience, and social persuasions were the sources that predicted the skills self-efficacy of above-level students.

Table 6

Multiple Linear Regression Results for the Prediction of Mathematics General Self-Efficacy and Skills Self-Efficacy

Variable	Mathematics General Self-Efficacy			Skills Self-Efficacy		
	Below-Level	On-Level	Above-Level	Below-Level	On-Level	Above-Level
	(<i>n</i> = 311)	(<i>n</i> = 1,367)	(<i>n</i> = 601)	(<i>n</i> = 311)	(<i>n</i> = 1,367)	(<i>n</i> = 601)
SES (β)	-.03	-.04	-.02	-.06	-.05*	-.15**
Mastery Experience (β)	.48**	.37**	.31**	.31**	.24**	.15*
Vicarious Experience (β)	.23**	.06	.08	.17*	.10*	.10*
40 Social Persuasion (β)	.07	.16**	.16*	.09	.09*	.17*
Physiological State (β)	-.04	-.14**	-.15*	-.08	-.17**	-.07
<i>F</i>	52.41	155.96	58.40	21.02	77.84	25.03
Model ²	.52**	.41**	.36**	.29**	.26**	.19**

Note. $p < .05$ * $p < .001$ **

Chapter 5: Discussion

The present study makes no argument for or against ability grouping. Instead, this study seeks to draw attention to the various ways that the educational practice of ability grouping may be related to (either directly or indirectly) to students' self-efficacy beliefs, which in turn could influence their academic performance and/or desire to enroll in future mathematics courses. Of course, there is also the possibility that ability grouping may be an effect and not a cause of students' belief systems. This attests to the reciprocity of three main factors in social cognitive theory, and highlights how each factor can influence the other two factors. The findings of this study draw attention to the differences in student beliefs at all academic levels within middle grade mathematics. More research conducted specifically on students' self-efficacy beliefs in the mathematics domain could contribute to dramatic gains in student success in the classroom.

Representation of Students in Ability Groups

The purpose of this thesis is to examine mathematics self-efficacy and its sources among middle school students in below-, on-, and above-level mathematics courses. The study also seeks to determine whether students in each ability group are represented proportionately by gender, ethnicity, and SES when compared to the full sample. In this study, I examined the possibility that there may be a difference in the distribution of students in each course placement level based on gender, race, or SES compared to the distribution of students within the full sample.

Findings revealed that boys and girls were evenly dispersed in below-level courses. Moreover, there were more boys in on-level courses and a greater number of girls in above-level courses. The latter finding is consistent with previous research that highlighted the recent increase of middle school girls who are enrolling in advanced, above-level mathematics courses (Pinker, 2009).

As many studies in the past have uncovered, results of this study revealed that the number of students from African American, Hispanic, and other racial backgrounds made up the majority of the sample in below- and on-level courses whereas White and Asian students comprised the majority of sample in above-level courses (Burris & Welner, 2005; Futrell & Gomez, 2008; Museus, Palmer, Davis & Maramba, 2011).

Results also revealed that students of lower socioeconomic status made up the majority of the sample in below-level courses, followed by on-level and above-level respectively. This finding is also consistent with previous researchers who found a disproportionate number of students from a lower socioeconomic background were often relegated to below-level courses (Boaler, 2006; Braddock & Dawkins, 1993).

Mean Differences

Next, I investigated the possibility that middle school students' self-efficacy beliefs differed as a function of their placement in ability-grouped mathematics courses. As in previous studies, students in above-level courses believed themselves to be more capable than those students in on-level tracks and reported higher efficacy experiences in mathematics than did their on-level or below-level peers (Usher & Pajares, 2009). Those most doubtful of their capabilities in mathematics are indeed those who have been placed

in below-level courses. School administrators ostensibly group students by ability with the aim of catering instruction to individual needs and not to stigmatize students in any way. Therefore, one might expect varying levels of self-efficacy within a given class, regardless of the mathematics level at which the class was structured.

These results suggest that ability grouping practices may have psychological consequences, because the largest differences observed in the study were in terms of students' self-efficacy across ability groups. Contrary to the Big-Fish-Little-Pond Effect, in which upper-level students' self-concepts suffer, students in this particular sample who were "big fish" were actually those with the highest self-efficacy (Marsh, 1984).

This study also examined Bandura's (1994) hypothesized sources of self-efficacy, to determine whether students in different ability-level groups reported different exposure to efficacy-relevant information. Most notably, results indicated that students placed in below-level mathematics courses relied more on vicarious experiences than students in on-level or above-level courses. Results from this thesis imply that teachers who work with students who might be behind or struggling in mathematics may find it beneficial to provide ample opportunity to expose students to models in mathematics.

This finding is similar to a trend reported by Usher and Pajares (2006) who concluded that students within each group relied upon different sources when forming their efficacy beliefs. This pair of researchers also found that mastery experiences, social persuasions, and physiological states were significant predictors of students' self-efficacy beliefs.

Although this study examined the sources of self-efficacy of students placed in varying ability based groups within the domain of reading, researchers reported the results as

tentative due to the small number of students in certain groups (e.g., the below-level group).

Additional results revealed that above-level students reported higher levels of mastery experience and social persuasions when forming their efficacy beliefs. Perhaps these students rely less on vicarious experiences because their history with mathematics has been positive and people around them (e.g., teachers, parents) tell them they are good at mathematics. Surprisingly, there were no differences among students regarding physiological state and this source was the lowest ranked among students at every course placement level. However, all physiological state items on the survey were negatively worded and lower levels actually equal lower levels of physiological state. Therefore, it appears that students' anxiety levels are not great enough to influence their beliefs regarding their capabilities in mathematics.

Regression Results

Finally, this study aimed to explain the relationship between the four sources of self-efficacy and students' general self-efficacy and skills self-efficacy in mathematics. The four sources of self-efficacy explained 41% of the variance of students' general self-efficacy and 25% of students' skills self-efficacy in mathematics. Thus, it appears that the model for predicting students' general self-efficacy in mathematics explains more of the variance. These findings provide evidence that students use other means besides mastery experiences, vicarious experiences, social persuasions, and physiological state when making judgments about their skills and general-self efficacy in mathematics.\

The four sources of self-efficacy are tightly interconnected and are heavily influenced by context. This is because different contexts change people's exposure to and interpretation of the four sources. For example, perhaps social persuasions are not resonating with below-level students in the same way as on- or above-level students. In order for below-level students to feel most confident about their capabilities in mathematics, they would prefer to watch models within their environment who can demonstrate how to successfully complete a task.

The negative beta for physiological state demonstrates that as negative physiological state went up (i.e., higher scores on physiological state scale), students' scores on measures of general mathematics self-efficacy scale went down. In other words, students who reported more mathematics anxiety/ negative physiological arousal also reported lower levels of self-efficacy in math.

Limitations and Future Directions

Several limitations to this study are worth noting. First, for students in sixth grade, schools reported that they did not have any "below-level" courses. As a result, there is a smaller group of students in below-level courses within the full sample. However, as I started collecting information regarding available courses for sixth grade students, I was easily able to identify the below-level courses within schools. Students enrolled in these courses had different teachers than their peers and were not enrolled in Mathematics 6 or Pre-Algebra. Second, is the temptation to infer a causal relationship between ability grouping practices and students' ratings of self-efficacy after reviewing the results, but this study only draws attention to the relationship between the two

concepts. In order to determine if their relationship is causal, future researchers could investigate the self-efficacy ratings of students who are randomly assigned to ability grouped classrooms.

Current research on ability grouping has focused on the multiple ways in which this educational practice can influence students' feelings of competence, self-esteem, and motivation to succeed in the classroom (Mantle, 2013). After conducting a study with ability grouped high school students, Assouline, Colangelo, Heo, and Dockery (2013) concluded that there is evidence to suggest that high-ability students need enrichment and acceleration in their regular curriculum in order to meet their learning needs. One of the goals of the present study is to highlight that *all* students need enrichment and acceleration in the curriculum to meet their learning needs and become successful. By understanding the different sources students use to form their efficacy beliefs and incorporating these types of experiences into the curriculum, teachers and educators alike can enrich the experiences of students at all academic levels.

Self-efficacy is apt to be most influential in predicting behavior when the environment is responsive and allows one to exercise one's capabilities without restraint (Bandura, 1986). If students are surrounded by peers of varying ability, then there is a higher chance that they will be exposed to multiple ways of approaching and solving a problem. Classroom instruction with students of similar academic background may not offer strategies that are challenging. According to Vygotsky (1978), being aware of the distance between what students can accomplish independently and what they can accomplish with the assistance of another peer or adult can help both educators to derive

a better understanding of the learner's immediate needs and how to help that learner successfully meet those needs.

Perhaps a heterogeneous classroom comprised of students of all ability levels in mathematics would provide students with a restraint free environment and teachers with a better sense of what students can accomplish independently and also what they can accomplish when paired up with a buddy whose mathematics skills are more developed. Although this thesis makes no case for or against ability grouped classrooms, results suggest that a mixed ability classroom might also strengthen students' self efficacy beliefs in mathematics in various ways. For example, above-level students in a mixed ability classroom would have the opportunity to receive social persuasions from their teachers and other peers while working through mathematical problems. Below-level and on-level students would have the opportunity to observe and interact with their above-level peers and perhaps pick up on some strategies that would enable them to feel more confident about solving difficult problems.

Findings from this study can be helpful to school administrators and other individuals who are interested in advocating for equity among students regarding course placement in middle grade mathematics. Results may also be helpful to researchers who study classroom operation and structure, because both of these things can expose learners to different sources of self-efficacy. Finally, this study might provide middle school administrators and policy makers alike with a better understanding of how to design a mathematics curriculum that not only appropriately accommodates for the needs of

students at *all* academic levels, but also one that enhances students' efficacy beliefs and future aspirations.

Appendix A

Item Code	Self-Efficacy Constructs
General Mathematics Self-Efficacy	
T6_Math_GSE_Test1	1. How confident are you that you can do well on standardized tests in math?
T6_Math_GSE_Test2	2. How confident are you that you can do a good job on important math tests?
T6_Math_GSE_Test3	3. How confident are you that you can do a good job on the math section of the KCCT test?
T6_Math_GSE1	4. In general, how confident are you in your abilities in math?
T6_Math_GSE2	5. How confident are you that you will do well in math this year?
T6_Math_GSE3	6. How confident are you that you can learn math?
T6_Math_GSE4	7. How confident are you that you will get an A in math this year?

Item Code	Self-Efficacy Constructs
Mathematics Skills Self-Efficacy	
Math_MSSE1	1. How confident are you that you can solve problems involving addition with carrying?
Math_MSSE2	2. How confident are you that you can solve problems involving subtraction with borrowing?
Math_MSSE3	3. How confident are you that you can solve problems involving multiplication with two-digit numbers?
Math_MSSE4	4. How confident are you that you can solve problems involving division with two-digit numbers?
Math_MSSE5	5. How confident are you that you can solve problems involving changing between fractions, decimals, and percents?
Math_MSSE6	6. How confident are you that you can solve problems involving adding and subtracting fractions?
Math_MSSE7	7. How confident are you that you can solve problems involving multiplying and dividing fractions?
Math_MSSE8	8. How confident are you that you can solve problems involving multiplying and dividing decimals?
Math_MSSE9	9. How confident are you that you can solve problems involving grouping shapes based on their properties (parallel sides, angles)?
Math_MSSE10	10. How confident are you that you can solve problems involving inequalities ($>$, $<$, \leq , \geq , \neq)?
Math_MSSE11	11. How confident are you that you can solve problems involving order of operations?
Math_MSSE12	12. How confident are you that you can solve problems involving word problems?
Math_MSSE13	13. How confident are you that you can solve problems involving equations with one variable?

Math_MSSE14	14. How confident are you that you can solve problems involving equations with two or more variables?
Math_MSSE15	15. How confident are you that you can solve problems involving graphing?
Math_MSSE16	16. How confident are you that you can solve problems involving finding perimeter, area, and volume?
Math_MSSE17	17. How confident are you that you can solve problems involving negative numbers?
Math_MSSE18	18. How confident are you that you can solve problems involving ratios and proportions?
Math_MSSE19	19. How confident are you that you can solve problems involving powers and exponents?
Math_MSSE20	20. How confident are you that you can solve problems involving rounding and estimating?
Math_MSSE21	21. How confident are you that you can solve problems involving tables, charts, diagrams, and coordinate grids?
Math_MSSE22	22. How confident are you that you can solve problems involving problems with more than one step?
Math_MSSE23	23. How confident are you that you can solve problems involving measurement?
Math_MSSE24	24. How confident are you that you can solve problems involving mean, median, range, and mode?
Math_MSSE25	25. How confident are you that you can solve problems involving chance and probability?
Math_MSSE26	26. How confident are you that you can solve problems involving explaining in words how you solved a math problem?
Math_MSSE27	27. How confident are you that you can solve problems involving doing quick calculations in your head?

Item Code	Sources of Mathematics Self-Efficacy
Mastery Experience	
Math_M1	1. I do well on even the most difficult math assignments.
Math_M2	2. I do well on math assignments.
Math_M3	3. I got good grades in math on my last report card.
Math_M4	4. Even when I study very hard, I do badly in math.
Math_M5	5. I have always been successful with math.
Math_M6	6. I make excellent grades on math tests.
Vicarious Experience	
Math_V1	1. Seeing adults do well in math helps me do better in math.
Math_V2	2. Seeing kids do better than me in math helps me do better in math.
Math_V3	3. When I see how another student solves a math problem, I can see myself solving the problem in the same way.
Math_V4	4. When I see how my math teacher solves a math problem, I can see myself solving the problem in the same way.
Math_V5	5. I imagine myself working through challenging math problems successfully.
Math_V6	6. I compete with myself in math.
Math_V7	7. On math tests, I always try to do better than I have before.

Social Persuasion

- | | |
|----------|--|
| Math_SP1 | 1. My math teachers have told me that I am good at learning math. |
| Math_SP2 | 2. Adults in my family have told me what a great math student I am. |
| Math_SP3 | 3. Other students have told me that I'm good at learning math. |
| Math_SP4 | 4. People have told me that I'm good at learning math. |
| Math_SP5 | 5. I have been complimented for my ability in math. |
| Math_SP6 | 6. My classmates like to work with me in math because they think I'm good at it. |

Physiological State

- | | |
|----------|--|
| Math_PH1 | 1. Just being in math class makes me feel stressed and nervous. |
| Math_PH2 | 2. Doing math work takes all of my energy. |
| Math_PH3 | 3. I start to feel stressed-out as soon as I begin my math work. |
| Math_PH4 | 4. My mind goes blank and I am unable to think clearly when doing math work. |
| Math_PH5 | 5. I get sad when I think about learning math. |
| Math_PH6 | 6. My whole body becomes tense when I have to do math. |

Note. Students rated their level of agreement with statements on a scale of 1 to 6.

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Vita

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Teaching Experience

Substitute Teacher, May 2010-May 2011

Fayette County Public Schools, Lexington, KY

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Ashland Elementary School, 4th Grade QUEST, Lexington, KY

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Julius Marks Elementary School, Kindergarten, Lexington, KY .

Teacher, 8/2007-7/2008

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Professional Experience

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KIDS NOW, University of Kentucky, Lexington KY

Data Entry Clerk, 08/2012-1/2013

STEPS/ Department of Radiology, University of Kentucky, Lexington KY

Case Manager, 5/2012-11/2012

Benchmark Family Services, Lexington, KY

Data Entry Clerk/Office Assistant, 3/2010- 6/2012

STEPS/ Associate Provost for Faculty Affairs, University of Kentucky, Lexington KY

Office Assistant, 7/2008-8/2009

Bluegrass Horseman Magazine, Lexington, KY

Professional Memberships

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American Psychological Association, (APA)

Division 15, graduate student member

License/Certifications

KELS/Teacher Internship Statement of Eligibility (SOE)

- Statement of Eligibility for Provisional Certificate for Teaching in Elementary School, Primary Through Grade 5 (Effective Date: 1/1/10 Expiration Date: 12/31/2014)

TEACHSTONE

- Certified Class Observer, K-3 (Effective Date: 2/13/14 Expiration Date: 2/13/15)

Professional Activities/Volunteer Services

P20 Motivation and Learning Lab, University of Kentucky Spring 2013-present

- Graduate student member
- Volunteer- data collection/peer mentoring

Fayette County Science Fair, Judge Fall 2009

- Veterans Park Elementary School

Certified in Project WET/Project WILD/ Project Learning Tree Spring 2009

- A three day professional development workshop sponsored by the State Botanical Garden of Kentucky/UK College of Agriculture that specifically focuses on teaching Kentucky core content-related science lessons outdoor

Skills

Microsoft Office
IBM SPSS Statistics

Paper and Poster Presentations

Taylor, A. G., Butz, A. R., Fanni, F., & Usher, E. L. (2013). *Sources of Adolescents'*

Mathematics Self-Efficacy: Differences as a Function of Ability Grouping. Paper submitted for presentation at the annual meeting of American Educational Research Association, Philadelphia, PA.

Taylor, A. G., Coyle, B. A., Meiners, N. C., Paoella, A. C., Butz, A. R., & Usher, E. L.

(2013, April). *Optimizing learner competence and confidence in middle grades mathematics*. Paper presented at the Spring Research Conference, Lexington, KY.

Hall, A. G., Butz, A. R., & Usher, E. L. (2014, August). *Ability grouping and self-*

efficacy: Enhancing competence in middle grades mathematics. Poster accepted for presentation at the American Psychological Association Convention, Washington, DC.

Hall, A. G., Dias, J. R., Husk, R., M. Butz, A. R., & Usher, E. L. (2014, April). *What's*

stopping you? A look at college barriers among rural Appalachian students.

Poster presented at the 4th Annual Children at Risk Conference, Lexington, KY.

Hall, A. G., Dias, J. R., Husk, R., M. Butz, A. R., & Usher, E. L. (2014, April). *What's*

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Poster presented at the Spring Research Conference, Cincinnati, OH.

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